

PHYSICS 222 SYLLABUS FALL 1996

August 7, 1996

Physics 222, Sections 1-12: Lectures MWF 1:10-2:00 p.m.

LECTURER: Dr. Stefan Zollner, A205 Physics, 294-7327; email: zollner@iastate.edu.

Physics 222, Sections 13-26: Lectures MWF 2:10-3:00 p.m.

LECTURER: Dr. Joseph Shinar, A303 Physics, 294-8706; email: shinar@ameslab.gov.

Newsgroup: isu.phys.222

WWW page: <http://femto.ssp.ameslab.gov/phy222/index.htm>

Helproom:

Room 83, Physics Hall. We will attempt to have the help room open as soon as possible. Hours will be posted.

All lectures are held in Room 5, Physics Hall. Exam and Lab rooms will be posted.

Course Secretary: Judy Zunkel, 12 Physics, 294-4936. Messages for the lecturers and recitation instructors may be left with the course secretary, if you are unable to contact them directly.

Textbook (required): Raymond A. Serway, *Principles of Physics* (1994).

Reading and homework assignments will be made from this textbook. Well-known alternative textbooks at the level of this course are those by Halliday/Resnick, Young/Freedman, Ohanian, Benson, and Tipler. The notation used in this course will follow Serway's notation, but there is very little variation in notation among different texts.

Student Solutions Manual: Contains complete solutions to many of end-of-chapter problems. (Some of these problems will be assigned as homework; they will not be graded, but similar ones may appear in a quiz or exam.)

Study Guide: Reviews important concepts and techniques, summarizes and explains key equations; also contains review problems and answers to selected questions from the textbook (some of which will be assigned as homework).

Additional Materials:

Physics 222 Laboratory Manual (required, to be purchased at the University Bookstore).

Physics 222 Laboratory Information and Schedule Sheet (distributed at first recitation).

Physics 221/222 Sample Exam Packet (1996 printing). Optional, may be purchased at the University Bookstore. I suggest you purchase this packet soon. If you wait until just a few days before an exam, the bookstore may be out of it and unable to print additional copies until after the exam. The solutions to some of the written problems are available at the web page <http://femto.ssp.ameslab.gov/phy222/exams.htm>.

Some lecture notes and problem assignments will be distributed in class and posted on the bulletin board.

Bulletin Board: In the hallway outside of Room 5, Physics Hall.

NOTE: THIS COURSE HAS EVENING EXAMS, see page 27 of the ISU Bulletin. **Note the exam dates of September 30, October 24, and November 21 on the schedule below, and MAKE NO OTHER PLANS FOR THESE DATES** The date of the final exam will be announced.

LECTURE SCHEDULE

DATE	LECTURE NUMBER AND TOPICS	READING/PROBLEM ASSIGNMENT
Note: Questions and problems in parentheses are solved in the Student Solutions Manual or the Study Guide.		
M Aug 26	1. Magnetism; magnetic field; magnetic force	Ch. 19:1-3; P4, P9, P13, P18, Q10.
W Aug 28	2. Magnetic torque; magnetic moment	Ch. 19:4; P20, P24.
F Aug 30	3. Combined electric and magnetic fields	Lecture notes. Ch. 19:Q11.
M Sep 2	LABOR DAY -- NO CLASSES	
W Sep 4	4. Biot-Savart law; field due to long straight wires	Ch. 19:5-6; P28, P31, P34.
F Sep 6	5. Ampere's law; solenoid	Ch. 19:7-8; P38, P41, P46.
M Sep 9	6. Induction; Faraday's law; motional emf	Ch. 20:1-2; (Q2), (Q4), Q5, P4, P8, P13, P21.
W Sep 11	7. Lenz's law; induced emf; generator; electric motor	Ch. 20:2-4; P18, P25, P26.
F Sep 13	8. Inductance, RL circuits, energy in inductors	Ch. 20:6-8; Q19, (Q21), P33, P40, P41, P45,
M Sep 16	9. Oscillations in LC circuits	Ch. 21:1-2,7;24:2; Ch. 21:P4, P14, P42
W Sep 18	10. Damped oscillations, RLC circuits	Ch. 21:5,7;

F Sep 20	11. Forced oscillations; RLC circuits; AM radio	Ch. 21:6-7; P36, P37, P46, P49.
M Sep 23	12. Mechanical waves; waves in strings	Ch. 22:1-3,5-6; Q5, P4, P14.
W Sep 25	13. Sinusoidal waves; transmitted energy; wave equation	Ch. 22:7-8; Lecture notes. P21, P28, P30.
F Sep 27	14. Sound waves; Doppler effect; shock waves	Ch. 22:9-11; P33, P40, P42, P47, P48
M Sep 30	no lecture (optional review session for Exam #1)	
M Sep 30	EXAM #1, 8:00-9:30 p.m. , covers lectures 1-13	
W Oct 2	15. Superposition; interference; standing waves	Ch. 22:4; P7; 23:1-2; P2, P8, P12, P13
F Oct 4	16. Normal modes; air columns; beats; Fourier analysis	Ch. 23:3-7; P18, P23, P27, P39
M Oct 7	17. Electromagnetic waves; Maxwell's equations	Ch. 24:1-3; Q1, (P3), P4, P5, P10, (P13)
W Oct 9	18. Poynting vector; radiation pressure; EM spectrum	Ch. 24:4-6; P12, P17, P18, P25, P26, P30
F Oct 11	19. Light: ray optics; reflection; refraction	Ch. 25:1-3; (Q4), (Q6), P9, P14, P16
M Oct 14	20. Dispersion; Huygen's principle; total internal reflection	Ch. 25:4-7; P23, (P29), (P31), (P33), P49
W Oct 16	21. Mirrors; ray tracing; mirror equation	Ch. 26:1-2; (P3), P10, (P13), P14
F Oct 18	22. Lenses; ray tracing; thin-lens equation	Ch. 26:3-4; P16, (P23), P30, P34, P42
M Oct 21	23. Interference: double-slit experiment	Ch. 27:1-3; (Q4), (Q5), Q6, P2, P7, P12, P15
W Oct 23	no lecture (optional review session for Exam #2)	
R Oct 24	EXAM #2, 8:00-9:30 p.m. , covers lectures 12-22	
F Oct 25	24. Interference: thin films; Newton's rings; wedge IF	Ch. 27:5-6; P26, P28, P30, P34
M Oct 28	25. Diffraction; single-slit experiment	Ch. 28:1-3; Q3, P2, P9, (P17), P19, P20
W Oct 30	26. Gratings; x-ray diffraction; polarization	Ch. 28:4-6; P24, P28, P30, P34, P43,
P45		
F Nov 1	27. Modern physics: black-body radiation; photoel. effect	Ch. 29:1-2; Q19, P2, P4, P8, P14, (P17)
M Nov 4	28. Compton effect; photons; particle-wave duality	Ch. 29:3-6; P22, P24, P32, P34, P35, P39
W Nov 6	29. Atomic models; Bohr model; hydrogen spectra	Ch. 30:1-2; P2; 11:9; P42; 12:5; P31
F Nov 8	30. Quantum numbers; Pauli principle; periodic table; lasers	Ch. 30:2-3,5-6,8-9; P5, P17, P23, (P25)
M Nov 11	31. Nuclear physics; radioactive decay; ¹⁴ C dating	Ch. 31:1-6; P1, P5, P8, P14, P24, P30, (P35)
W Nov 13	32. Particle physics; fundamental forces; quarks	Ch. 32:1-10; P2, P5, (P11), P12, P19, P22
F Nov 15	33. Pressure; temperature; thermal expansion	Ch. 13:1-4; P5, P6, P18, P19, P22
M Nov 18	34. Ideal gas law; kinetic theory	Ch. 13:5-6; P25, P26, P33, P36, P41, P44
W Nov 20	no lecture (optional review session for Exam #3)	
R Nov 21	EXAM #3, 8:00-9:30 p.m. , covers lectures 23-33	
F Nov 22	35. Specific heat; latent heat	Ch. 14:1-3; P1, (P7), P10, P14, P20, P21
Nov 23 - Dec 1	THANKSGIVING BREAK, NO CLASSES	
M Dec 2	36. Work; internal energy; First law of thermodynamics	Ch. 14:4-5; P31, P33, (P35), P38
W Dec 4	37. First law of thermodynamics: applications	Ch. 14:6; P40, P42, P46, (P58)
F Dec 6	38. Heat engines; Second law of thermodynamics	Ch. 15:1-2; P1, P2, P4
M Dec 9	39. Carnot engine; heat pump; refrigerator; time's arrow	Ch. 15:3-5; P7, P17, (P19)
W Dec 11	40. Entropy	Ch. 15:6-9; P25, P26, P31, P35
F Dec 13	41. Review session for Exam #4.	
To be announced	EXAM #4 , emphasis on lectures 33-40 and lab, some comprehensive questions	

The first part of the assignment for each lecture is a reading assignment from the textbook. You should read it, as carefully as possible, before the lecture. This reading cannot be overemphasized. Your ability to digest the lecture will probably be incomparably improved if you invest the 20-30 minutes to read the listed sections, before they are covered during the lecture.

The second part of the assignment consists of questions and problems from the textbook. These are NOT to be turned in for grading by your instructor. Rather, they are intended to improve your understanding of the subject. We will attempt to cover these items during the lecture. Some of them will likely be addressed, either explicitly or implicitly, in the quizzes and exams. Note that questions and problems in parentheses are solved in the Study Guide or the Student Solutions Manual.

EVENING EXAMS are used in this course so that all students can take the same exam at the same time and thus be graded on the same basis. Room assignments and instructions will be issued in advance of each exam. The exams this semester will have the following format: The evening exams will be approximately one-half written problems and one-half multiple-choice questions which stress the understanding of physics concepts. The final exam will be multiple-choice only.

The lecturers will write the evening exams based on the material they covered in the lectures and assigned as homework (including the reading and problem assignments in this syllabus). Some of this material may also be the basis of labs for some or

all students. The final exam also contains questions written by the lab supervisor. All students (including those with a lab waiver) need to answer the lab questions on the final.

The exam will include the values of any physical constants you may need. Bring to the exam a Number 2 pencil. **You should also bring a calculator.** (As a minimum, this calculator should be able to calculate square roots, trigonometric, exponential, and logarithmic functions, and also standard deviations.) A programmable or charting calculator is not required, but may be used. A formula sheet will be supplied with the exam. It will also be distributed in class before the exam to enable you to better plan your preparations for the exam.

Dates and times for night exams for all large courses are coordinated by the University administration, and thus cannot be changed by the Department of Physics and Astronomy or your lecturers. It is assumed that all students who enrolled in Physics 222 did so in full knowledge of the night exam dates and times, which were published on page 27 of the ISU Bulletin (schedule of classes booklet).

Policy for make-up tests: Make-up tests will be allowed only in exceptional circumstances, such as illness, family emergencies (not anniversaries, etc.), or **official** university-sponsored activities. Students who know in advance that they will miss a test (for example because of competing in a Big-8 athletic event or ROTC training) must explain the circumstances to their lecturer well before the exam and seek permission for a make-up. After the fact, such permission will not be granted. Students who miss the test because of unexpected illness or other unforeseen emergencies should send a message (by phone, voice-mail, e-mail, or through a friend) to the lecturer or the course secretary before the start time of the exam in order to receive permission to take the make-up exam. Also see the rules on page 45 of the ISU 1995-97 Bulletin.

Exams will normally be returned in the Tuesday recitation during the week following the exam. At this time, the recitation instructors may also present model solutions and answer questions about the exam. If you believe that you have been misgraded on an exam question, you must return your exam, together with a written note explaining the problem, at the recitation at which the exam is returned to you. **Do not write on the exam itself!** If you believe that there is a problem with machine-grading of the multiple-choice part of your exam, please contact the course secretary or your lecturer.

Students often ask what they should study for the exams. The answer is: (i) Read the chapter summaries in your textbook. If necessary, review the appropriate sections or go over your lecture notes. (ii) Review the lecture questions and the recitation assignments. (iii) The material in the Student Solutions Manual or the Study Guide offers chapter summaries and solutions to questions and problems. (iv) Get a copy of past exams (may be purchased from the University Book Store) and study the questions, problems, and their solutions. The solutions to some of the written problems are available at the web page <http://femto.ssp.ameslab.gov/phy222/exams.htm>.

Students with special needs (for lectures, recitation, labs, or exams) should contact their lecturer or the course secretary.

COURSE GRADES are based on a numerical score determined as follows:

Three night exams, each worth 65 points maximum	195 points
Final examination, worth 100 points maximum	100 points
Recitation-Laboratory grade, worth 105 points	105 points
Maximum total	400 points

This course will be graded on an absolute basis, not on a “curve”. If your numerical score is at least 200, you will pass the course; if you have a total of at least 260, 300, or 340 points, respectively, you will be guaranteed to receive a grade of at least C-, B-, or A-, respectively. These numbers will not be raised, but they may be lowered. After each exam, we will post a sheet with your (approximate) current grade.

Regardless of the numerical score, a failing grade will be given if:

- (1) any laboratory has not been satisfactorily completed, or**
- (2) the student has engaged in any form of academic dishonesty.**

If you have completed the laboratory part successfully during a previous semester at ISU, you may wish to contact the course secretary about a lab waiver during the first week of classes. If this waiver is granted, your recitation/lab grade will solely be based on your performance in recitation. You still have to answer the lab questions on the final exam.

Since the course is graded on an absolute basis, it is to your advantage to work with other students to learn the material. Helping another student to do well will not adversely affect your grade. Quite to the contrary, the extra effort on your part to think about

the material will likely help you to do better on the exam. If you are having difficulties with some of the concepts, another student might help you to understand it better than the textbook or lecturer. We encourage you to work together and perhaps form study group. You may meet in the Physics 222 helproom, if you wish. The helproom schedule is posted on the 222 Bulletin Board and outside Room 83 (the helproom; see below). Please see the academic honesty statement for guidelines about working on the homework assignment in a group.

RECITATIONS AND LABS: Students are expected to attend (all) recitation sessions having worked all or most of the assigned problems. They should be ready to discuss them in class. The recitation instructors may call in your written solutions at any time.

The assignments due on Tuesdays are to be turned in at the beginning of the recitation period. Those due on Fridays are to be turned in before the lecture. They may also be placed in the green "Incoming Mail and Homework" box in Rm. 12 Physics (or in the mailbox outside the south entrance to Rm. 12, if the office is closed) **no later than 4:30 p.m.** Be sure to write your name, course number, section number, and your TA's name on the top of the first page. The homework solutions will usually be posted around 4 p.m. on Tuesdays and 5 p.m. on Fridays. They will also be sent to the Reserve Room of the Parks Library. **No homework will be accepted after the solutions have been posted.**

The recitation/lab part of the course grade will be based on the quality of your homework solutions, performances on quizzes, oral presentations, and the quality of your laboratory work (including prelabs). Your recitation/lab instructor will give you more details about how he or she will grade your particular section.

The importance of the recitation and laboratory periods cannot be over-emphasized. You do not understand the material of the course if you cannot apply it to the solution of the problems. Working the assigned problems for yourself is an essential way of gaining this level of understanding. You should regard the assignments as the bare minimum of problem solving needed to gain a passing grade in the course. Exam questions will not be exactly the same as the assigned homework problems. However, most exam problems will be based on situations similar to those in the homework problems, and should be solved using the same principles and methods. Similarly, you do not understand the material of the course if you cannot relate it to real situations in the laboratory. In addition, the laboratory is essential to give you some understanding of the experimental foundations of physics as well as scientific instrumentation.

STUDENT ASSISTANCE

There are several opportunities for students to receive assistance with the material of this course. In particular,

* A bulletin board for Physics 222 is in the hallway outside Room 5. It will contain announcements, problem solutions, exam results, and other information about the course.

* Room 83 Physics will be the Physics 222 Help Room, normally open most of the day Mondays through Fridays. Check the schedule on the door for exact times. A microcomputer will often be available in the help room to use for purposes associated with the course; the available software will be described on a sheet left near the computer.

SUGGESTED STUDY PLAN

Physics 222 is a five-credit course, so the university expects you to spend about 15 hours a week on this course, counting class time. Be sure to attend lecture, recitation, and laboratory regularly; students who do this naturally receive higher grades because of their better understanding of physics. Since class time totals 6 hours a week, you should spend about 9 hours a week outside of class on the course. A possible division of this time might be:

- 1 hour a week reading the assigned textbook pages before lecture.
- 2 hours a week on a careful re-reading of the textbook assignment and lecture notes after the relevant lecture; polish up your lecture notes at this time.
- 2 hours a week on the questions and exercises from the textbook listed with the lecture schedule.
- 4 hours a week working on the recitation and pre-lab assignments.